

REMARKS

This responds to the Office Action dated February 23, 2006.

Claims 1, 12, and 13 are amended, and claim 11 is canceled. Claims 1-10 and 12-20 are now pending in this application.

§103 Rejection of the Claims

Claims 1-20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Hartley et al. (U.S. Patent No. 6,161,042) in view of Salo et al. (WO 00/78391), which corresponds to U.S. Patent No. 6,278,894. The rejections are traversed and reconsideration is respectfully requested.

Claims 1 and 12 have been amended herein to recite devices for sensing minute ventilation by measuring impedance that include, among other things, circuitry for detecting noise when no excitation current is supplied by filtering the voltage sense signal when no excitation current is supplied into the ventilation band, circuitry for computing an average noise level, and circuitry for operating a switch matrix to select a configuration of voltage sense electrodes for use by the device that result in the lowest average noise level. Claim 13 has been amended herein to recite a method for sensing minute ventilation by measuring impedance that includes, among other things, detecting noise in the voltage sense signal while no excitation current is supplied for first and second voltage sense electrode configurations by filtering the voltage sense signal when no excitation current is supplied into the ventilation band, computing an average noise level, and selecting the configuration of voltage sense electrodes that results in the lowest average noise level. Applicant does not believe that the recitations of claims 1, 12, and 13 as amended herein are taught or suggested by the prior art of record.

As explained in the specification, in order to obtain a signal reflective of minute ventilation, a transthoracic impedance signal must be filtered to remove both low and high frequency components that are not related to minute ventilation. Such low frequency components of the impedance signal include both a zero frequency or DC voltage that represents the transthoracic impedance at full expiration and lower frequency voltages that represent impedance changes due to the slow changes in the residual volume of the lungs that occur as the

subject alternates between deep and shallow breathing. The high frequency components of the impedance signal not related to minute ventilation includes a voltage signal representing impedance changes resulting from the changes in ventricular blood volume as the heart beats. Exemplary lower and upper cutoff frequencies for bandpass filtering of the transthoracic impedance signal in order to remove these unwanted high and low frequency components are on the order of 0.05 and 1 Hz, respectively, which define a ventilation band in which the signal reflective of minute ventilation is found. What amended claims 1, 12, and 13, now recite is circuitry for, or the steps of, detecting noise by filtering the voltage sense signal when no excitation current is supplied into the ventilation band and computing an average noise level from the filtered signal.

In rejecting claim 11, the office action states that the Hartley reference discloses that the voltage sense signals are further filtered into the ventilation band in order to detect a noise level during a noise detection operation, citing col. 12, line 11 to col. 13, line 13 of the Hartley reference. Applicant respectfully asserts that this is incorrect. The cited portion of the Hartley reference only describes noise being detected in the signal that is output from demodulator 415 while no excitation current is supplied. There is no suggestion in the reference for further filtering the demodulated signal when no excitation current is supplied into the ventilation band by means of, for example, bandpass filter 420. The voltage sense signal obtained during a noise detection operation, as described in both the Hartley reference and the present application, reflects only noise from external sources such as cardiac electrical activity or environmental electromagnetic noise since there is no excitation current supplied that would result in an impedance signal. In the devices described in both the present application and the Hartley reference, when excitation current is supplied during normal operation, the action of the demodulator on a bipolar excitation current waveform results in high pass filtering of that portion of the voltage sense signal due to external noise as well as low pass filtering of that portion of the voltage sense signal due to impedance changes in order to remove the excitation current waveform from the signal. This means that there could still be high frequency external noise in the voltage sense signal that is passed by the high pass filtering function of the demodulator, but such noise is removed during normal operation by bandpass filter 420 which removes all frequency components except for the ventilation band. If the same bandpass filtering is not

performed during a noise detection operation with no excitation current being supplied, the computed noise level could therefore contain high-frequency noise due to external sources that would be filtered out during normal operation. Selecting the configuration of the voltage sense electrodes that results in the lowest noise level based upon a signal that contains noise in a frequency range that would be filtered out during normal operation could result in a less than optimum electrode configuration. The devices and method as set forth in claims 1, 12, and 13 overcome this problem.

Dependent claims 2-10 and 14-20 add particular limitations to the patentable subject matter recited by claim 1 or 13, respectively, which limitations are asserted be neither taught nor suggested by the prior art of record in that context. Additionally, applicant does not concede that the recitations of claims 1, 12, and 13 before the present amendment are taught or suggested by the combination of the Hartley and Salo references and reserves the right to prosecute those claims in one or more subsequent continuation applications.

CONCLUSION

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney (847) 432-7302 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

SCOTT FREEBERG

By his Representatives,

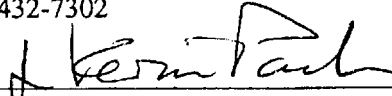
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